(12) UK Patent Application (19) GB (11) 2 359 438 (13) A

(43) Date of A Publication 22.08.2001

(21) Application No 0004061.8

(22) Date of Filing 21.02.2000

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(51) INT CL⁷
H04N 5/92 , G11B 20/00

(52) UK CL (Edition S)
H4F FEHX
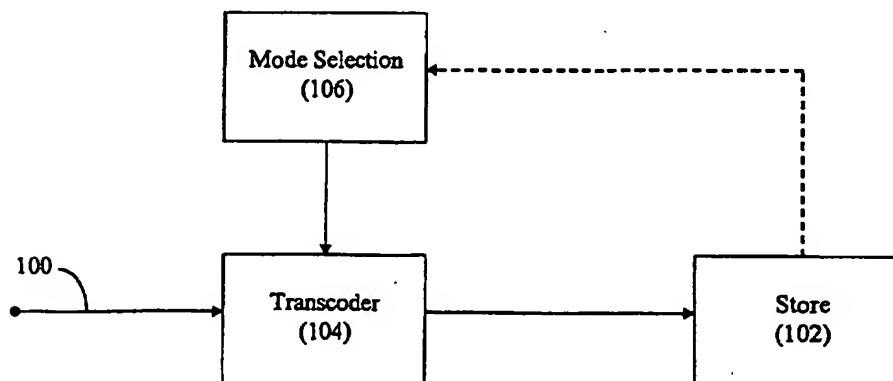G5R RHC

(56) Documents Cited
US 5982723 A
WPI Abstract Accession No. 1996-431064 &
JP 8214058 'Seamless concatenation - a 21st century
dream' <URL:http://www.bbc.co.uk/atlantic/
montpap.htm>

(58) Field of Search
UK CL (Edition R) G5R RHC RHX , H4F FEHX FGXX
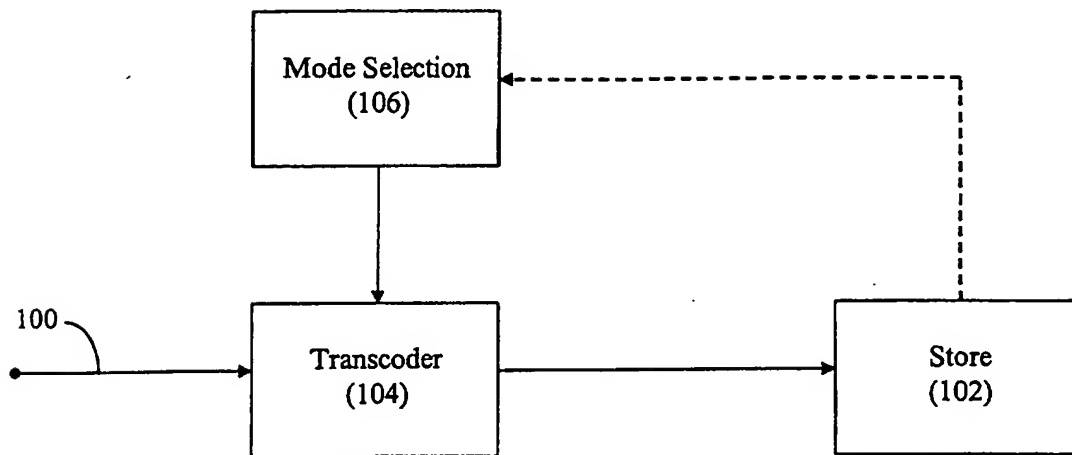INT CL⁷ G11B 20/00 , H04N 5/92
Online: WPI, EPODOC, JAPIO, INSPEC

(54) Abstract Title
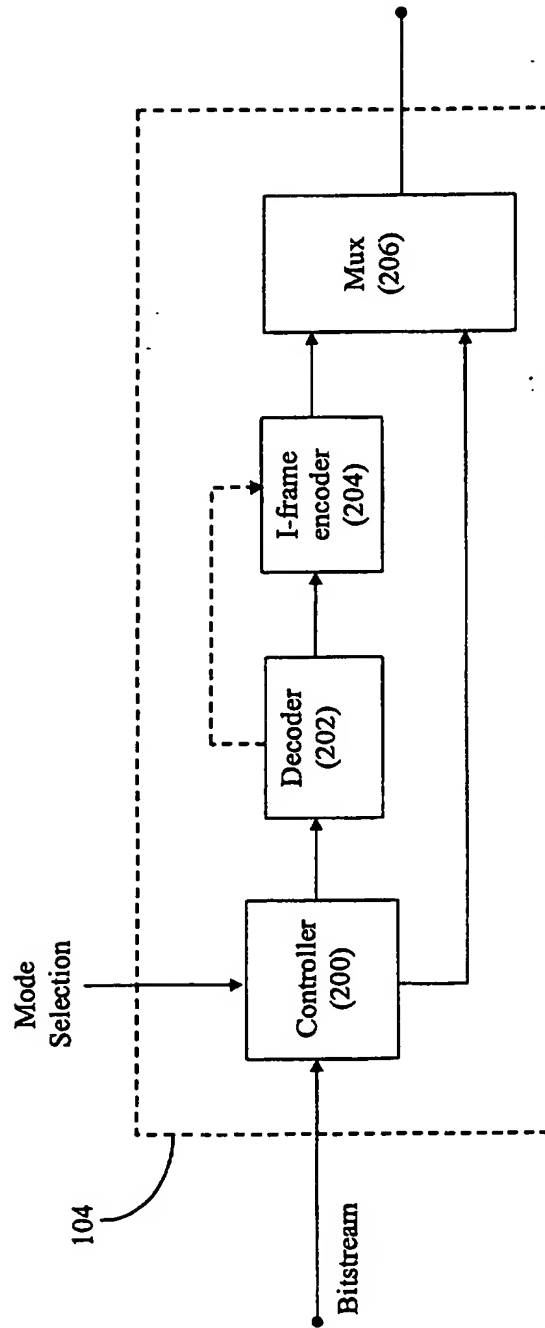**Method of changing bit rate in accordance with user selected storage mode**

(57) A method of processing a compressed digital video bitstream wherein the bitstream is received and is transcoded to a bitstream having a different bit rate reflecting the storage mode selected by a user. The storage modes available may include long play (having a lower bit rate than the received bitstream), compress-to-fit (having a bit rate reflecting available storage space) and rapid access (having an increased bit rate , with P frames being recoded as I frames to allow high speed searching). The transcoding may include the steps of decoding the received signal, extracting the coding decisions and recoding using the extracted decisions.

Fig 1

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Mode Selection
(106)

100

Transcoder
(104)

Store
(102)

Fig 1

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Fig 2

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COMPRESSED BITSTREAMS

This invention relates to compressed bitstreams and in the most important example to the processing of compressed bitstreams prior to storage.

5   The television viewer has, through the video cassette recorder (VCR) become accustomed to time-shifting broadcast television programmes. that is to say recording a television programme off air for viewing at a more convenient time. The VCR has also created an alternative distribution channel for video content in the form of the sold or hired video tape. The VCR has been

10   developed to offer a range of additional features. Typically, a video tape can be played at an increased speed with a recognisable picture still being displayed, to enable particular material to be located. Advanced VCRs will often provide the capability of freeze-framing or of stepping frame-by-frame through selected scenes. Another feature that is frequently available is that of "long play", where

15   the user elects to compromise the recording quality in return for a longer recording interval on a given length of tape.

In the move to digital television, proposals are already being made to imitate the functionality of a VCR through other storage media such as hard disks or re-writable CDs or DVDs. It has already been recognised that new

20   storage media offer capabilities considerably beyond those of the VCR, such as the ability to record and play back simultaneously to give a "pause" effect in essentially real time viewing.

The compressed nature of broadcast digital video does, however, present challenges in providing functionality analogous to that of an advanced

25   VCR. Generally, a bitstream delivered to the viewer (whatever the method of distribution) will be a relatively low bitrate and in the MPEG case will contain relatively few intra-coded frames.

It is an object of one aspect of the present invention to address this difficulty.

30   Accordingly, the present invention consists in one aspect in a method of processing a compressed digital video bitstream, comprising the steps of receiving a bitstream; establishing a plurality of user-defined storage modes; on

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user selection of a given one or more of said storage modes, transcoding the received bitstream to a transcoded bitstream having a different bitrate, reflecting the selected storage mode and storing the transcoded bitstream.

5   The invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a block diagram illustrating an embodiment of the present invention; and

10   Figure 2 is a block diagram of one form of the transcoder shown in Figure 1.

Referring initially to Figure 1, a compressed bitstream is received at terminal 100 and, instead of passing directly to the store 102 is received by a

15   transcoder 104. In accordance with the invention, the user is provided the option of selecting storage modes through mode selection block 106. One such storage mode is "long play" and upon selection of this mode, the transcoder receives from the mode selection block a control signal. In accordance with this control signal, the transcoder operates to transcode the

20   received bitstream to a transcoded bitstream having a selected lower bitrate. In this way, the programme material represented by the received bitstream can be accommodated by using a lesser portion of the store 102.

In certain known arrangements, a user interface is provided, enabling the user to instruct recording of a given television programme. In such a

25   circumstance, the arrangement according to this example of the invention can operate to determine first the amount of available storage capability in the store 102. If this is less than that required to record the entire programme at the broadcast bitrate, the mode selection block 106 can recalculate a bitrate at which the entire programme can be recorded. This recalculated bitrate is

30   provided to the transcoder which performs the transcoding operation as before.

In another storage mode, the user can select to store the received bitstream at the lowest bitrate consistent with a defined quality of video image.

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Using , for example, the quality measure disclosed in PCT/GB99/03356, the bitstream can be analysed and a quality measure determined. Using this measure in feedback, the transcoder will in this storage mode reduce the bitrate of the transcoded bitstream until the quality measure reaches a defined

5   threshold.

In one form of this invention, the transcoder 104 operates in accordance with the disclosure of EP 0 765 576 and EP 0 913 058. As disclosed in these references, an incoming bitstream can be decoded to an uncompressed or less compressed bitstream, with the coding decisions being extracted. The

10   uncompressed or less compressed signal can then be re-encoded at the required bitrate utilising the same coding decisions, so as to minimise or remove losses in re-encoding. The transcoding operation can also usefully take advantage of the disclosure of EP 0 963 657.

In another form of the present invention, the mode selector 106 permits

15   selection of a mode in which the transcoder operates to <u>increase</u> bitrate. As has been explained, the received bitstream will typically take the form of a long GOP MPEG bitstream, that is to say a bitstream in which there are relatively few intra-coded or I frames and a relatively large number of predicted frames which may take the form of forward predicted frames (P frames) or both

20   forward and backward predicted frames (B frames). If such a long GOP bitstream is written directly to store, operations such as a highspeed search for picture material, freeze frame and so on will be complex and time consuming. Unless the available functionality is to be confined to the relatively infrequent I frames, some form of decoding operation will be required within each trick

25   mode function.

In accordance with the present invention, this difficulty is overcome, where storage capacity permits, by modifying the received bitstream before it is written into the store. Thus the received bitstream is modified by reducing the amount of prediction coding. In one example, identified P frames in the

30   received bitstream will be decoded and re-encoded as I frames. Thus as shown in Figure 2, the incoming bitstream is received by a controller 200. This is under the control of the mode selection block 106. Independence upon the

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user preference and the amount of available storage, it is elected to convert all or a given proportion of P frames into I frames. Thus the controller passes some or all P frames to a decoder 202 where, with information of course from the associated I frame, a decompressed picture signal is derived. This is re-
5   encoded in I frame encoder 204 to provide a sequence of I frames which are multilplexed in multiplexer 206 with the remaining, undisturbed frames, to form a transcoded bitstream output. Advantageously, appropriate coding decisions are forwarded from the decoder 102 to the I frame encoder 204.

In another form of the invention, the number of intra-coded macroblocks
10   within a picture is increased by a defined proportion. Typically, a given number of P type macroblocks will be converted to I type macroblocks. This feature has particular advantage in those trick modes which utilise a portion only of any one picture. Thus, by analogy with a VCR shuttle mode, it can be arranged that a recognisable picture is provided in a search mode by combining
15   respective different picture regions from different incoming frames. By generally increasing the number of intra-coded macroblocks and by specifically ensuring that those picture regions which are to be used to produce a combined picture are coded as I type macroblocks, the present invention can considerably facilitate such an arrangement.

20   It should be understood that this invention has been described by way of example only and that a wide variety of further modifications are possible without departing from the scope of the invention.

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CLAIMS

1.   A method of processing a compressed digital video bitstream, comprising the steps of receiving a bitstream; establishing a plurality of user-defined storage modes; on user selection of a given one or more of said storage modes, transcoding the received bitstream to a transcoded bitstream having a different bitrate, reflecting the selected storage mode and storing the transcoded bitstream.

2.   A method according to Claim 1, wherein the received bitstream is compliant with a given compression standard and the transcoded bitstream is compliant with the same standard.

3.   A method according to Claim 1 or Claim 2, wherein the bitrate of the transcoded bitstream is less than that of the received bitstream.

4.   A method according to any one of the preceding claims, wherein the transcoding step comprises the steps of decoding to an uncompressed or less compressed signal, extracting coding decisions and re-encoding the uncompressed or less compressed signal utilising some or all of said extracted coding decisions.

5.   A method according to any one of the preceding claims, comprising the steps, on user selection of a given one of said storage modes, of determining an amount of available storage and transcoding the received bitstream to the bitrate calculated with reference to said storage.

6.   A method according to any one of the preceding claims, wherein the step of transcoding, comprises reducing the degree of prediction within the received bitstream.

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7.   A method according to Claim 1, wherein the step of transcoding comprising the conversion of at least a portion of the prediction coded matter into intra-coded matter.

8.   A method according to Claim 7. wherein said portion is a macroblock.

9.   A method according to Claim 7, wherein said method is a frame.

7.

Application No: GB 0004061.8   **Examiner:** Ms Ceri Witchard
Claims searched: 1-9   **Date of search:** 8 September 2000

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK Cl (Ed.R): H4F (FEHX FGXX) G5R (RHC RHX)
Int Cl (Ed.7): H04N 5/92 G11B 20/00
Other: Online: WPI, EPODOC, JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X, Y	US 5982723 LASER DYNAMICS See column 3 line 60 to column 4 line 12.	X: 1 at least Y:2-9
Y	WPI Abstract Accession No. 1996-431064 & JP 8214058 VICTOR CO See abstract	5
Y	'Seamless concatenation - a 21ˢᵗ century dream' Available via the Internet at <URL:http://www.bbc.co.uk/atlantic/montpap.htm>	2-9

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